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THE UNIVERSITY OF KANSAS EXPEDITION INTO THE JOHN DAY REGION OF OREGON.

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THE University of Kansas takes pride in its natural-history museum, the largest of any state institution in the country, and almost annually sends one or more expeditions into the field to add to the collections. These explorations have covered a good part of western North America, but until last summer no Kansas party had visited the extreme northwestern portion of the United States. With a desire to make the material in the museum as representative as possible, the zoology department conducted an exploration through the John Day region of central Oregon in search of mammalian fossils. It has been the custom to record in the Transactions of the Kansas Academy of Science the general nature of the explorations conducted by the museum, and for this reason I thought it desirable to make some mention of the one sent to Oregon.

The party, consisting of Messrs. Martin, Baumgartner, Hoskins, and myself, all of the zoology department, outfitted at La Grande and started west over the Blue mountains on July 1. The collecting ground had not been approached from this direction, and it was hoped that some advantage might accrue from this fact, but experience showed that the limited size of the field placed no premium upon any particular entrance into it. This will be apparent from the description of the region which I will give.

The John Day river has its head waters in the eastern range of the Blue mountains, and in its earlier course traverses a roughly triangular basin bounded by different spurs of these mountains. Within this basin there are three divisions of the river—the north fork, the east fork, and the south fork—which unite together before the stream finally turns north to flow into the Columbia river. It is upon the main river, which, just before joining the north fork, runs north and south, that the principal collecting grounds are found. Through the elevated basin the various branches of the river meander, cutting great canyons down through the Columbian lavas that overspread the whole of this part of Oregon. The entire region is indescribably rough, and when one views the relatively low-lying basin from an elevation it appears as if a veritable carni-

val of chaos had disported itself over the land. Such an assemblage of crags, ridges and mounds it would be hard to imagine. A few level spots are found along the streams, but the valleys are very narrow, and it is with extreme difficulty that roads are made. And even when they are once established there are many chances that they will not endure, for heavy waterspouts rush down the narrow canyons piling up great boulders and excavating deep gorges across and along the passageways. There is as great a fear of these deluges in the mountains of Oregon as there is of cyclones upon the plains of Kansas. It is but a few years since the small town of Heppner lost over 500 lives in one of these visitations. Vegetation is very scanty, and the whole region is bare and uninviting.

Into this arena we penetrated with difficulty, after a long journey over the mountains, and settled down to work on the main river in a locality called Turtle Cove. This is a fairly representative portion of the region, and I will describe it in some detail. Just here the river runs almost due north and south for a distance of about twenty miles, through a valley that will average about five miles in width. The hills rise precipitously on each side to a height of about 1500 feet, and from their bases long, slanting terranes extend in toward the river, which winds in and out at the bases of their interdigitating extremities. As many as twenty-two lava-beds may be seen in the hills, and for most of the distance in Turtle Cove they lie approximately horizontal. The terranes are largely composed of lava fragments, but now and then exposures of the John Day formation may be seen lifting themselves into prominence against the darker colored background.

Merriam makes three divisions of the John Day deposits, the lower, middle, and upper, and all of these may be found in Turtle Cove. The lower offers no attractions to the paleontologist, for animal remains have not been found in it, but the peculiar rounded hills into which it forms on exposure make a most striking landscape. Almost all colors of the rainbow may be seen, but the prevailing ones are chocolate red and pea-green. Frequently the dark red mounds are banded with undulating stripes of white, which produces a most bizarre effect. The shades of color vary with the direction of the light, but always have a soft effect. On close inspection the mounds are found to be covered with about six inches of loose soil, cracked into small bits, and it is to this condition that the varying shades of color and the soft effect are due. Underneath their superficial layer the unweathered shale constitut-

ing the mound is to be found. It is rarely that the lower John Day is to be seen lying underneath the upper layers; more commonly the area occupied by this formation is an exposed valley whose floor is covered by ascending series of these mounds which finally abut against the lava hills.

The middle and upper John Day series resemble each other and differ materially from the lower. They occur in steep cliffs of ashy gray or bright green color, and weather into vertical columns which rest upon harder layers, usually of white or pink, that extend approximately horizontally through the face of the exposure. The whole mass of material is cracked and seamed, and consists of hardened nodules, between which is a softer matrix of the same sort of material. When the irregular hardened masses are exposed on all sides they slake off in concentric layers, which break down and finally leave only scattered fragments of flint-like hardness. These small pieces of hard substance lie upon all surfaces where they can lodge and make the footing of one who climbs upon the cliffs very uncertain. Such exposures occur only occasionally, and there would seem to be no continuous formation over the whole basin. Whether there ever was such a one is very uncertain, but if this was the case then there must have been very extensive weathering and erosion before the Tertiary lava flows buried the region.

The individual exposures of the middle and upper John Day are from 100 to 500 feet high, and in the search for specimens it is necessary to crawl over the surface of these almost vertical cliffs and to look very carefully for bone fragments. Compared with many other collecting grounds in the Miocene there are here comparatively few specimens, but by careful work we were able to find enough to keep us busy most of the time. It is a very difficult matter to remove the bones in good condition because of the lack of homogeneity in the matrix. On digging into the cliff after a specimen it will be found that for a part of the distance the bones will lie in the hard nodules, and will then for a while extend along in the seams that are filled with much softer material. For this reason it is impossible to remove any large part of a skeleton in one piece, and the individual bones have to be carefully removed and pasted up in cloth. The bones themselves, however, are in an excellent state of preservation and make beautiful specimens.

Most of the fossils in this region are mammalian, but in some places turtles are numerous. The commoner specimens belong to

the family of the Oredons, which have a considerable range in size. These animals are now entirely extinct and show characters belonging both to deers and pigs. Primitive horses of several genera are common, as are also various camels and rhinoceroses. Primitive pigs, cats and dogs are found here, but we were not fortunate enough to secure many specimens of them. Rodents of various kinds are not uncommon.

There is not a little dispute about the age of the beds and the manner of their deposition, but the consensus of opinion seems to be that they are Miocene lake deposits. From the nature of the beds and the contained fossils, it would appear as though the lake were shallow and subject to frequent filling up with ashy deposits. The character of the material and the condition of the skeletons embedded in it would seem to indicate that the animals had fallen into a muddy place that later had been cracked by drying, and then once more had been subjected to a mud flow that had filled up the earlier cracks. Only a very careful study of the whole region, after the manner of that conducted by Merriam, would make it possible to determine the nature and sequence of the changes that were involved in the laying down of these interesting deposits.

Our party spent the greater part of the summer in the Turtle Cove region and then descended the river into the Haystack Valley locality. A short time was spent here, and then we took our way over the mountains to make the bend of the river where Bridge creek flows into it. In this historical collecting ground we had no success, and were obliged to end up the season with the least successful expenditure of our time. We left the John Day basin on the west side, after having traversed it from one end to the other, and, from the elevated plateau that bounds it, looked back upon the broken and serried ridges through whose valleys we had been wandering. It was a sight to be long remembered, and I believe there are few like it elsewhere. We reached a branch railroad at Shaniko and here shipped the greater portion of our freight. Final disposal of our team and wagon was made at The Dalles, on the main line, and from this time on we were in civilized surroundings to which there attaches no interest.